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(54) NETWORK STREAM IDENTIFICATION FOR OPEN FACETIME

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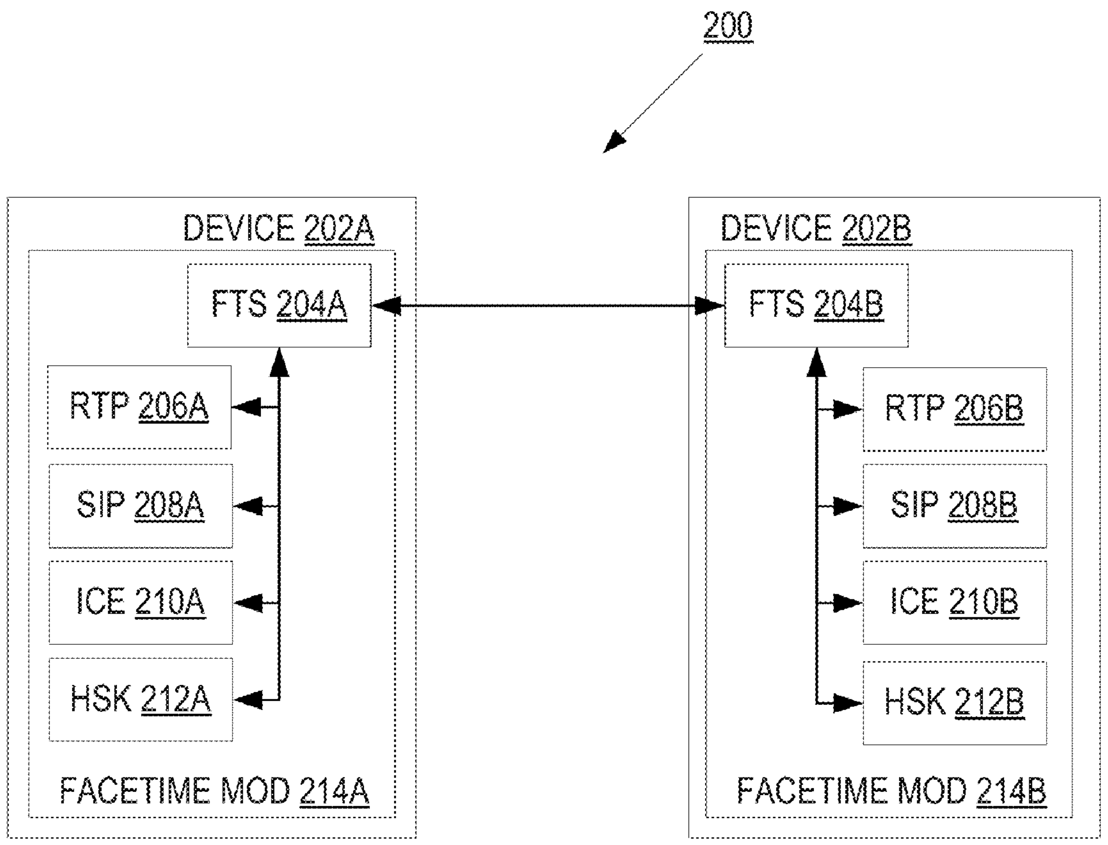
(57) **ABSTRACT**

A method and apparatus of a device that distinguishes multiplexed media and signaling data traffic is described. In an exemplary embodiment, the device receives, on a single port, a packet of the multiplexed data traffic, where the multiplexed data traffic includes a plurality of packets and each of the plurality of packets is one of a media packet and an encapsulated signaling packet. The device further examines an initial data element of a header of the received packet to determine if the received packet is one of a media packet and a signal packet. The device further forwards the packet to a corresponding module for further processing based on the examining.



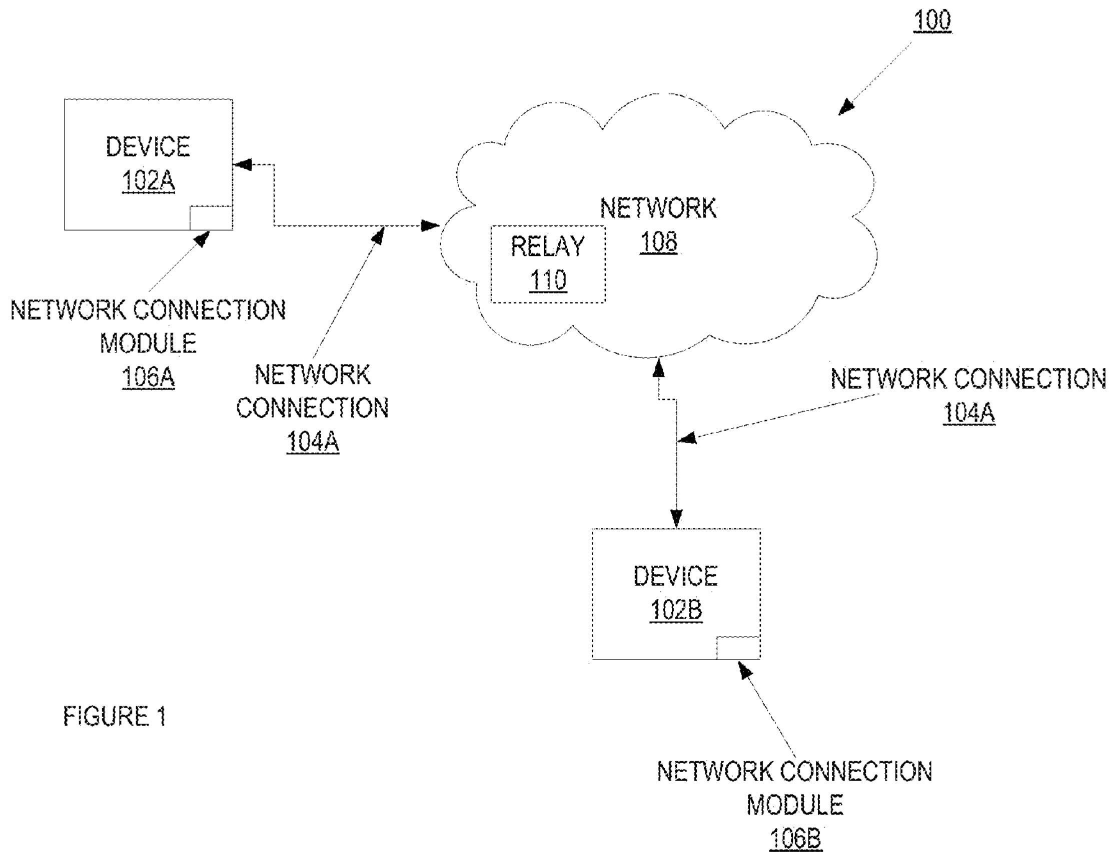

100
DEVICE
102A
NETWORK CONNECTION MODULE
106A
NETWORK CONNECTION
104A
NETWORK
108
RELAY
110
NETWORK CONNECTION
104A
DEVICE
102B
NETWORK CONNECTION MODULE
106B

FIGURE 1

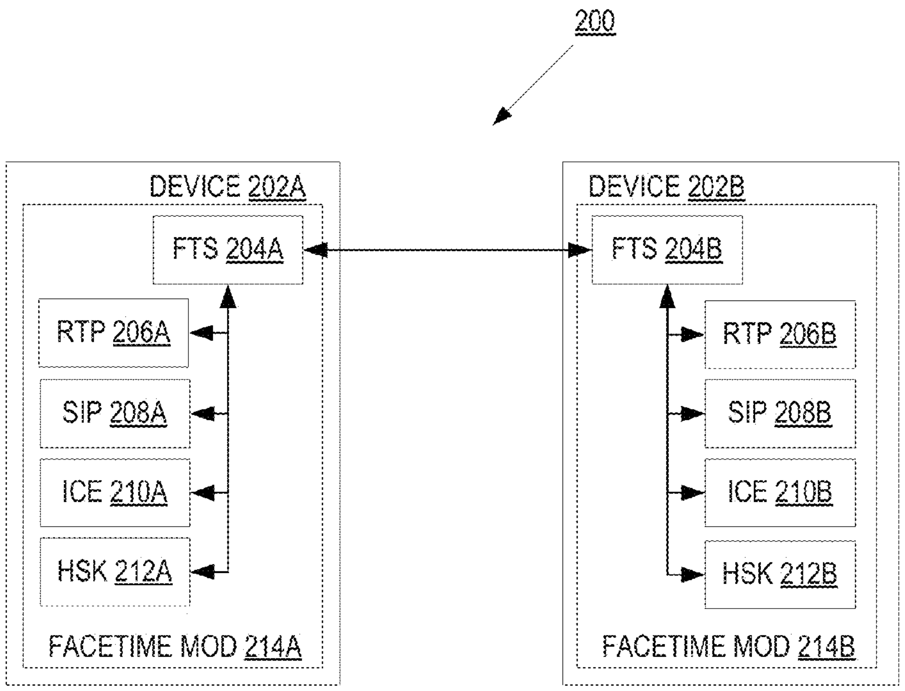

200
DEVICE 202A
FTS 204A
RTP 206A
SIP 208A
ICE 210A
HSK 212A
FACETIME MOD 214A
DEVICE 202B
FTS 204B
RTP 206B
SIP 208B
ICE 210B
HSK 212B
FACETIME MOD 214B

FIGURE 2

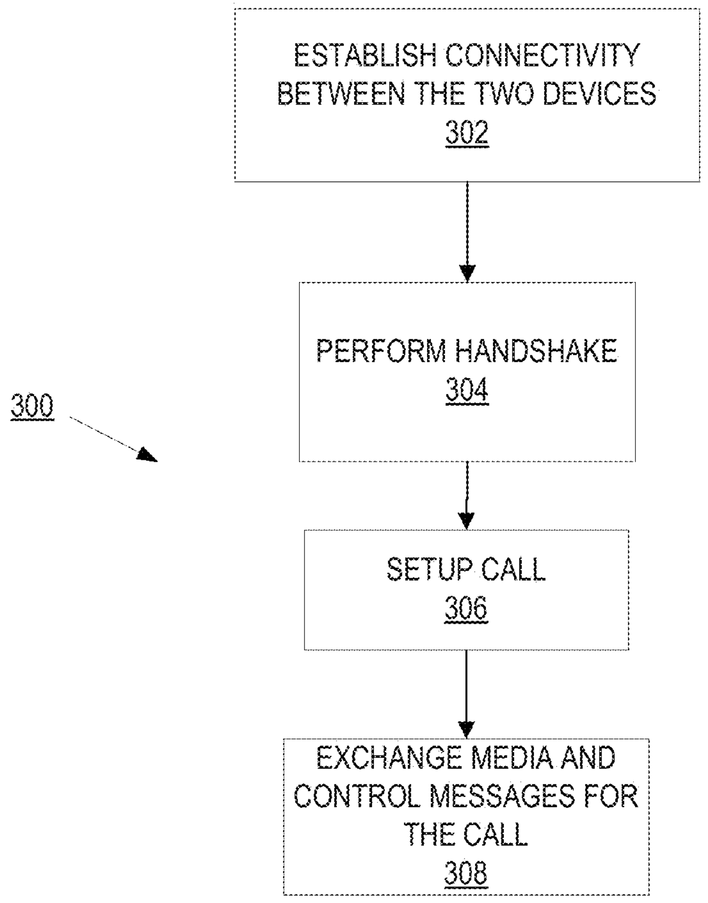

ESTABLISH CONNECTIVITY BETWEEN THE TWO DEVICES
302
PERFORM HANDSHAKE
304
300
SETUP CALL
306
EXCHANGE MEDIA AND CONTROL MESSAGES FOR THE CALL
308

FIGURE 3

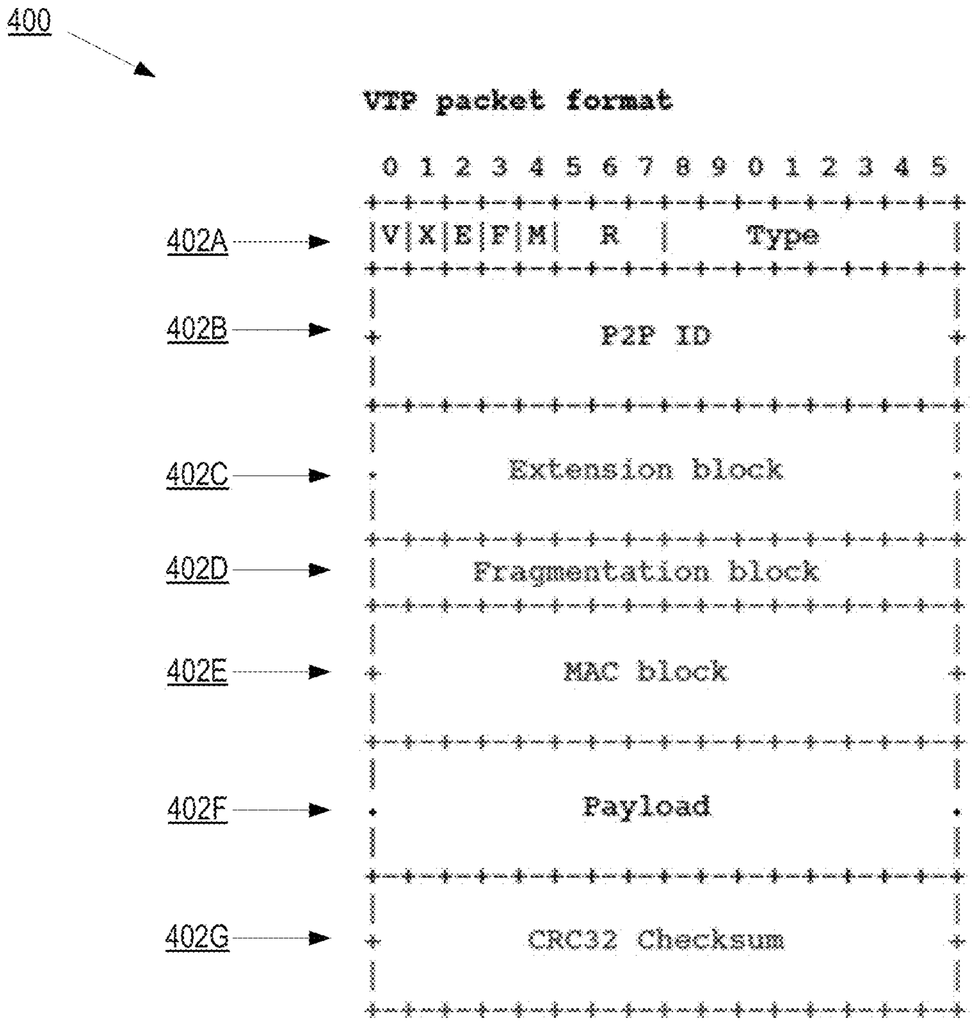

400
VTP packet format
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
V
X
E
F
M
R
Type
P2P ID
Extension block
Fragmentation block
MAC block
Payload
CRC32 Checksum
402A
402B
402C
402D
402E
402F
402G

FIGURE 4

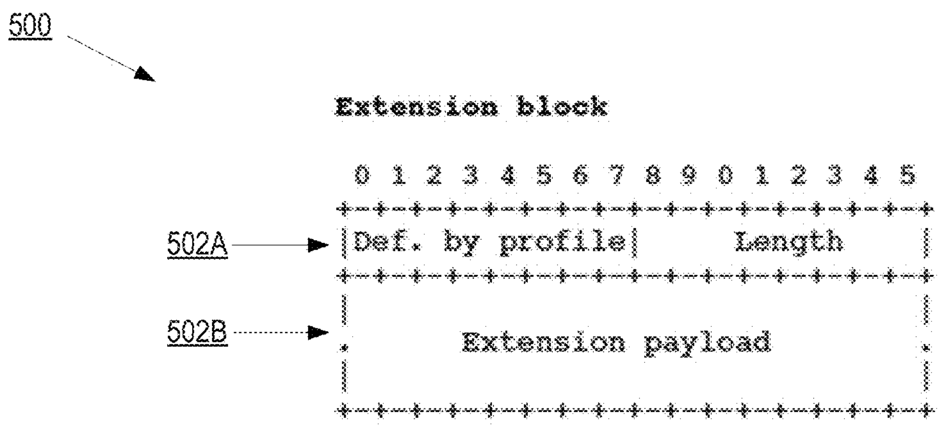

500
Extension block
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
502A
Def. by profile
Length
502B
Extension payload

FIGURE 5

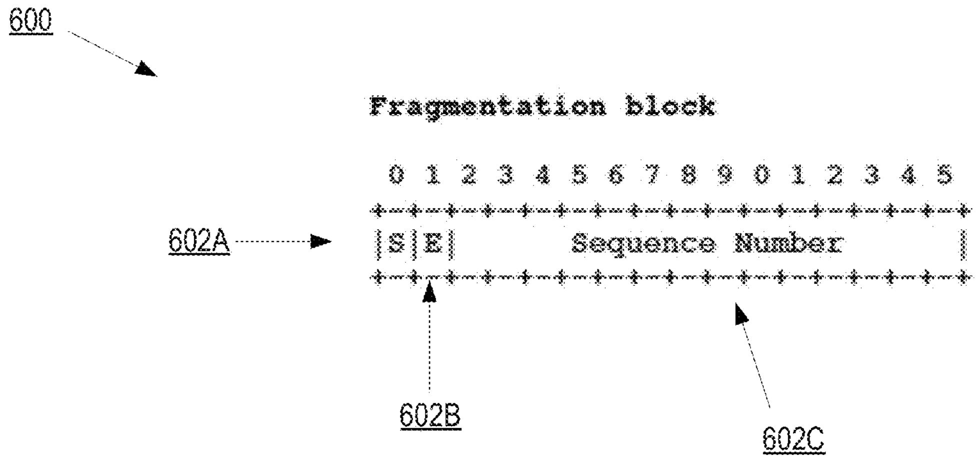

600
Fragmentation block
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
S
E
Sequence Number
602A
602B
602C

FIGURE 6

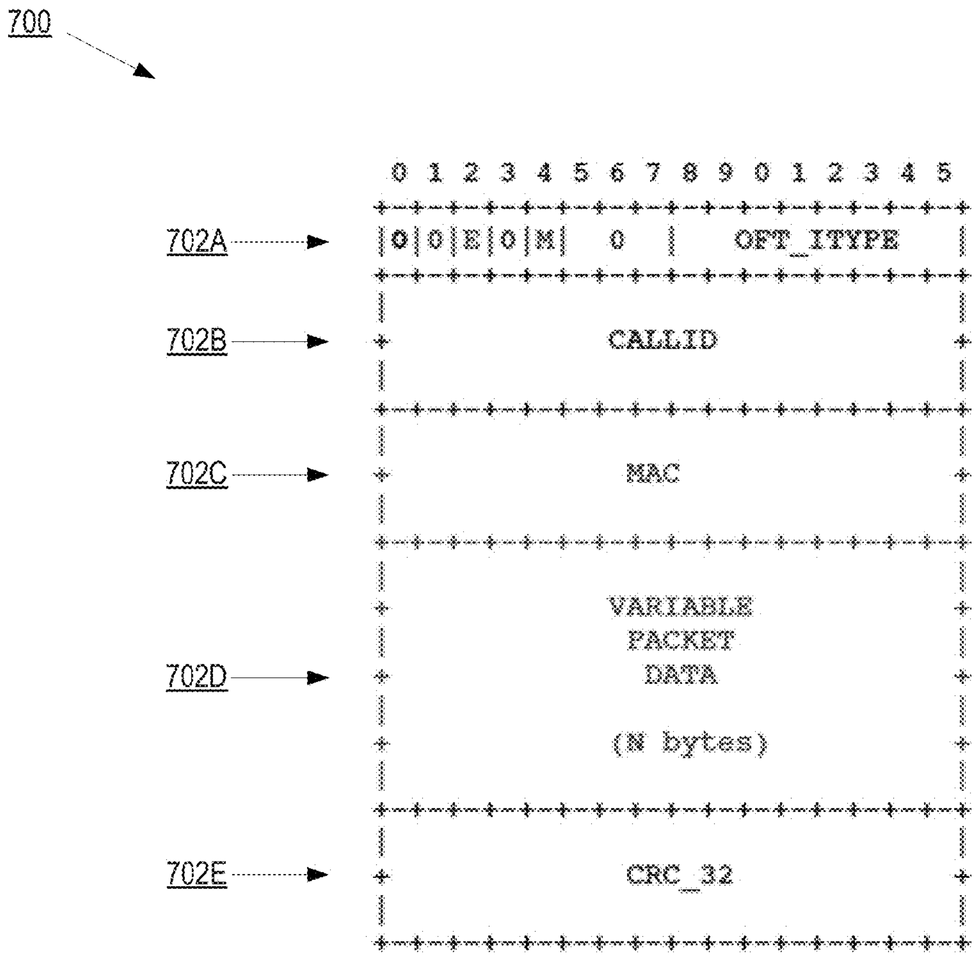

700
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
702A
0
0
E
0
M
0
OFT_ITYPE
702B
CALLID
702C
MAC
702D
VARIABLE
PACKET
DATA
(N bytes)
702E
CRC_32

FIGURE 7

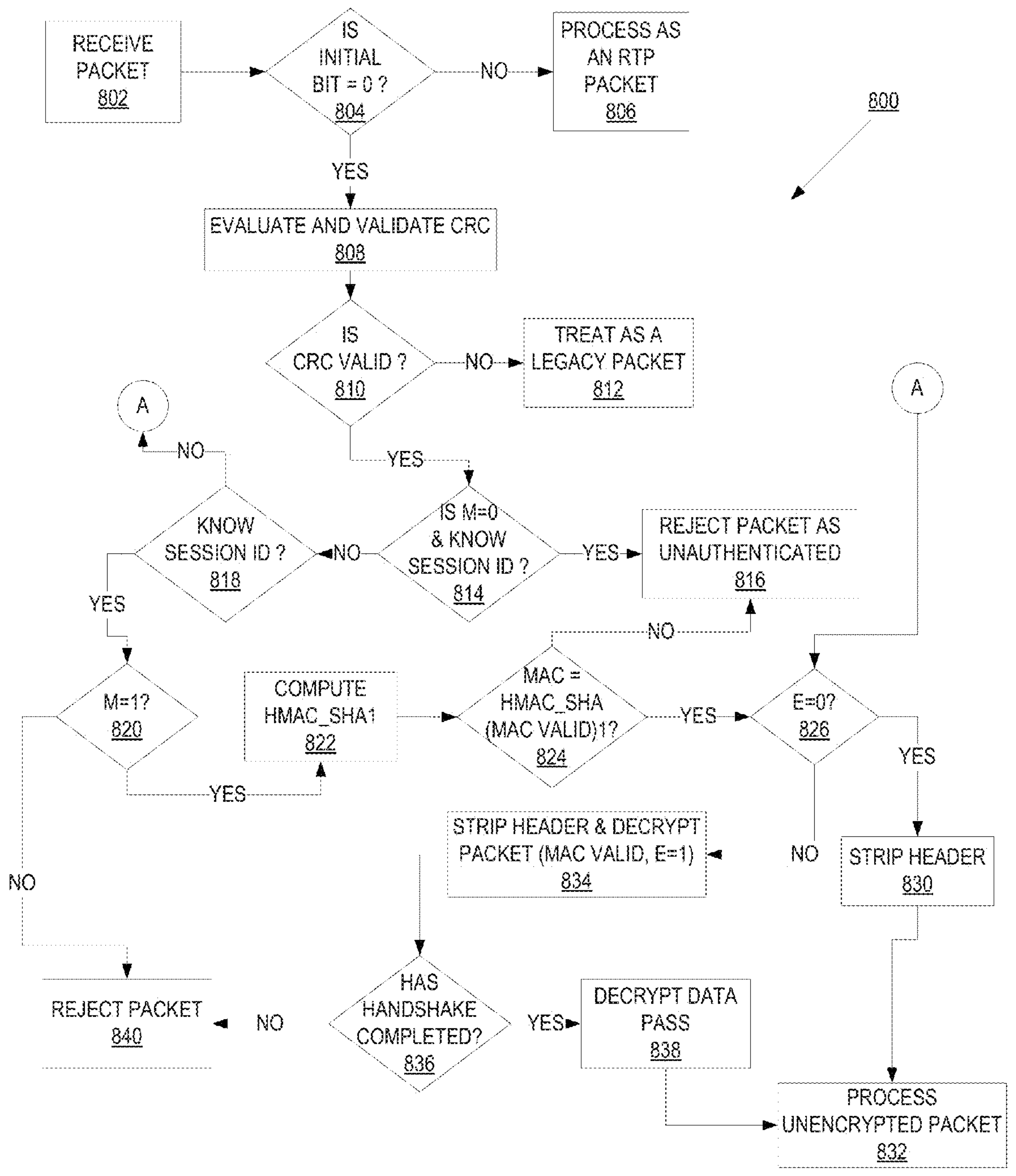

RECEIVE PACKET 802
IS INITIAL BIT = 0 ? 804
NO
PROCESS AS AN RTP PACKET 806
800
YES
EVALUATE AND VALIDATE CRC 808
IS CRC VALID ? 810
NO
TREAT AS A LEGACY PACKET 812
A
NO
YES
KNOW SESSION ID ? 818
NO
IS M=0 & KNOW SESSION ID ? 814
YES
REJECT PACKET AS UNAUTHENTICATED 816
A
YES
NO
M=1? 820
COMPUTE HMAC_SHA1 822
MAC = HMAC_SHA (MAC VALID)1? 824
YES
E=0? 826
YES
YES
STRIP HEADER & DECRYPT PACKET (MAC VALID, E=1) 834
NO
STRIP HEADER 830
NO
REJECT PACKET 840
NO
HAS HANDSHAKE COMPLETED? 836
YES
DECRYPT DATA PASS 838
PROCESS UNENCRYPTED PACKET 832

FIGURE 8

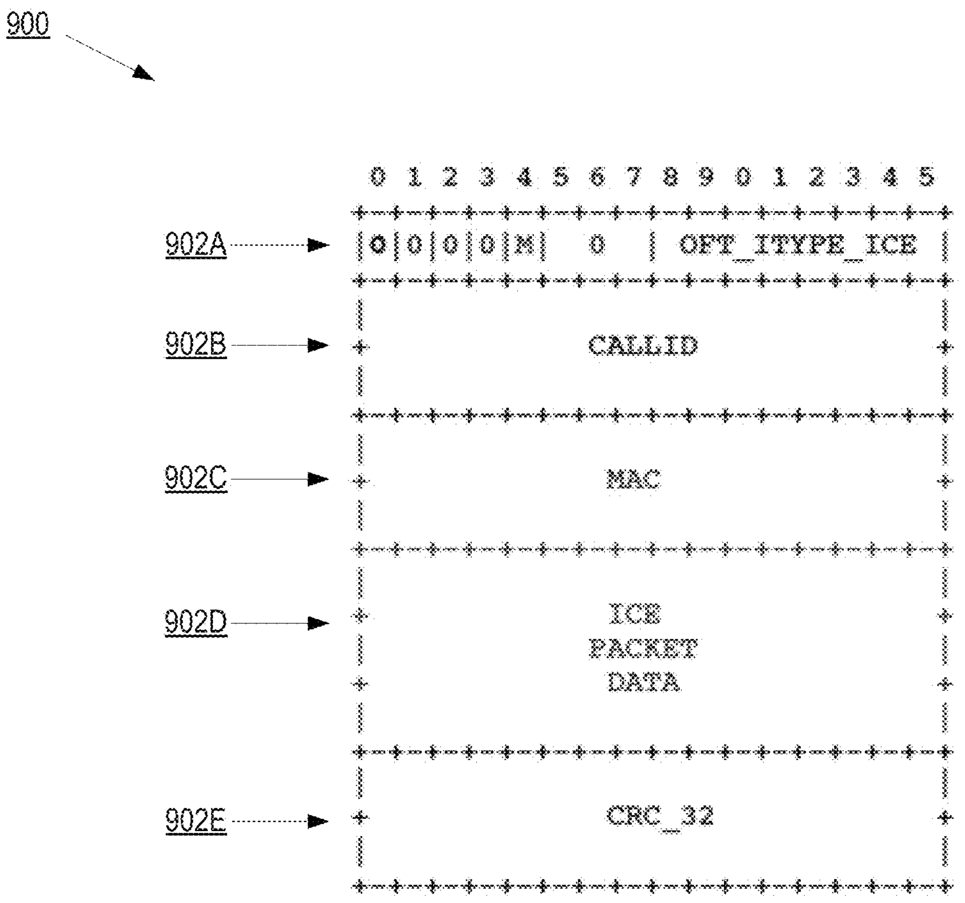

900
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
902A
|0|0|0|0|M| 0 | OFT_ITYPE_ICE |
902B
CALLID
902C
MAC
902D
ICE
PACKET
DATA
902E
CRC_32

FIGURE 9

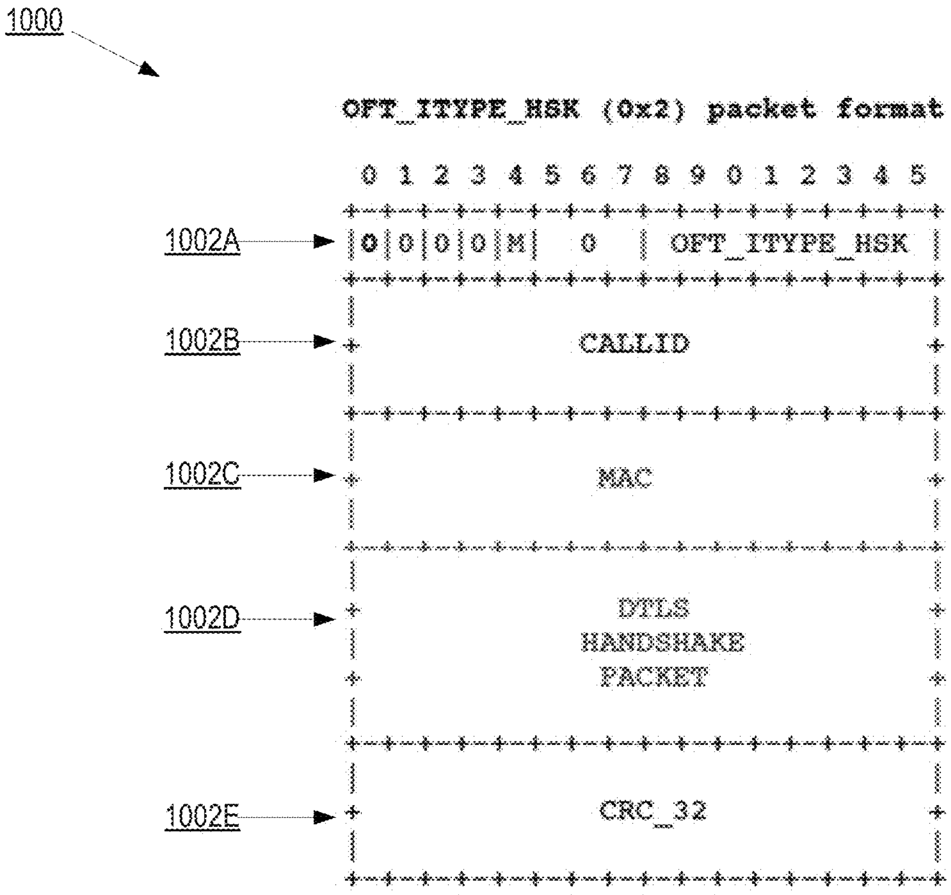

1000
OFT_ITYPE_HSK (0x2) packet format
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
1002A
0 0 0 0 M 0 OFT_ITYPE_HSK
1002B
CALLID
1002C
MAC
1002D
DTLS HANDSHAKE PACKET
1002E
CRC_32

FIGURE 10

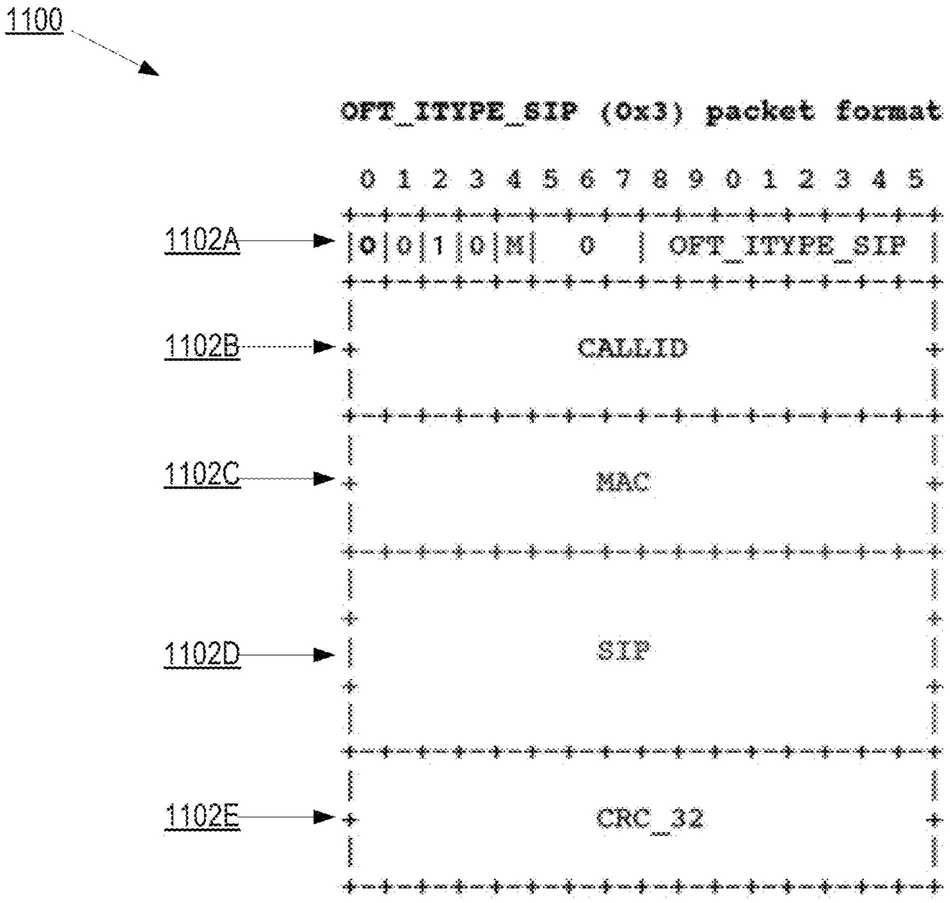

1100
OFT_ITYPE_SIP (0x3) packet format
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
1102A
0
0
1
0
M
0
OFT_ITYPE_SIP
1102B
CALLID
1102C
MAC
1102D
SIP
1102E
CRC_32

FIGURE 11

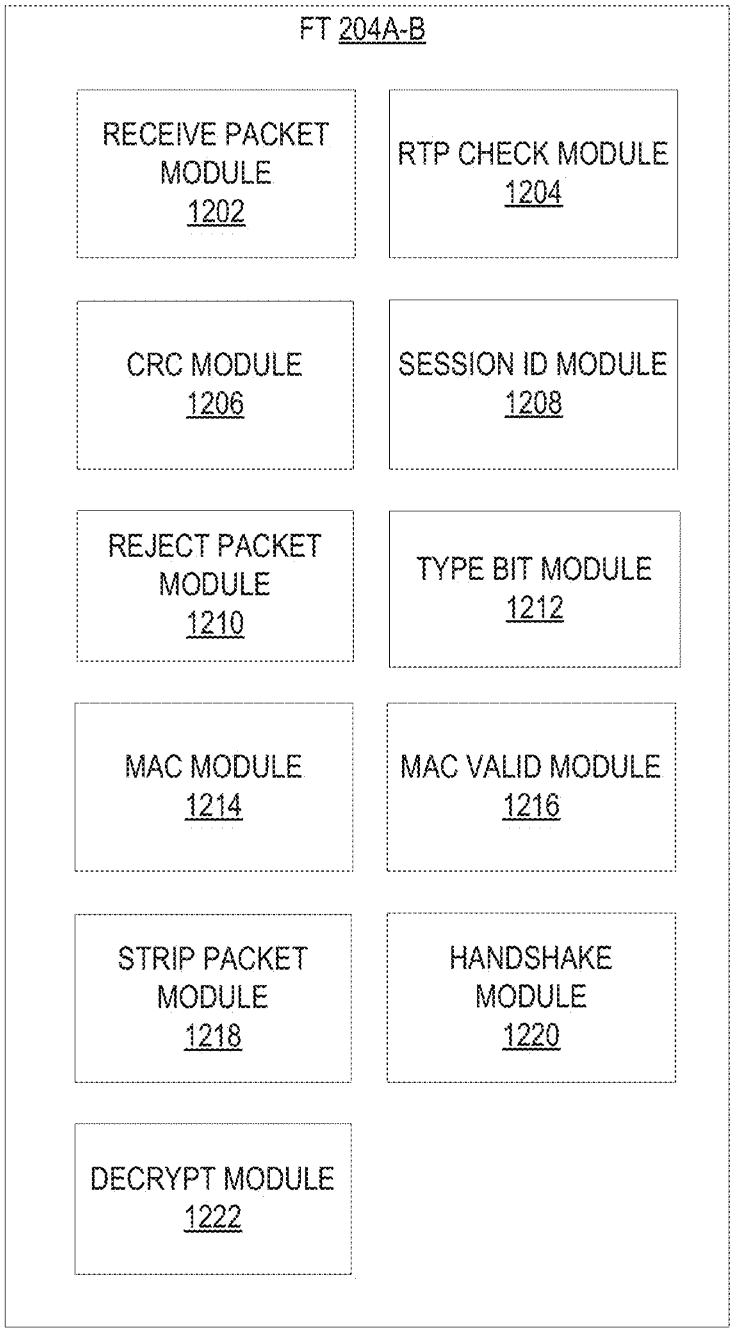

FT 204A-B
RECEIVE PACKET MODULE 1202
RTP CHECK MODULE 1204
CRC MODULE 1206
SESSION ID MODULE 1208
REJECT PACKET MODULE 1210
TYPE BIT MODULE 1212
MAC MODULE 1214
MAC VALID MODULE 1216
STRIP PACKET MODULE 1218
HANDSHAKE MODULE 1220
DECRYPT MODULE 1222

FIGURE 12

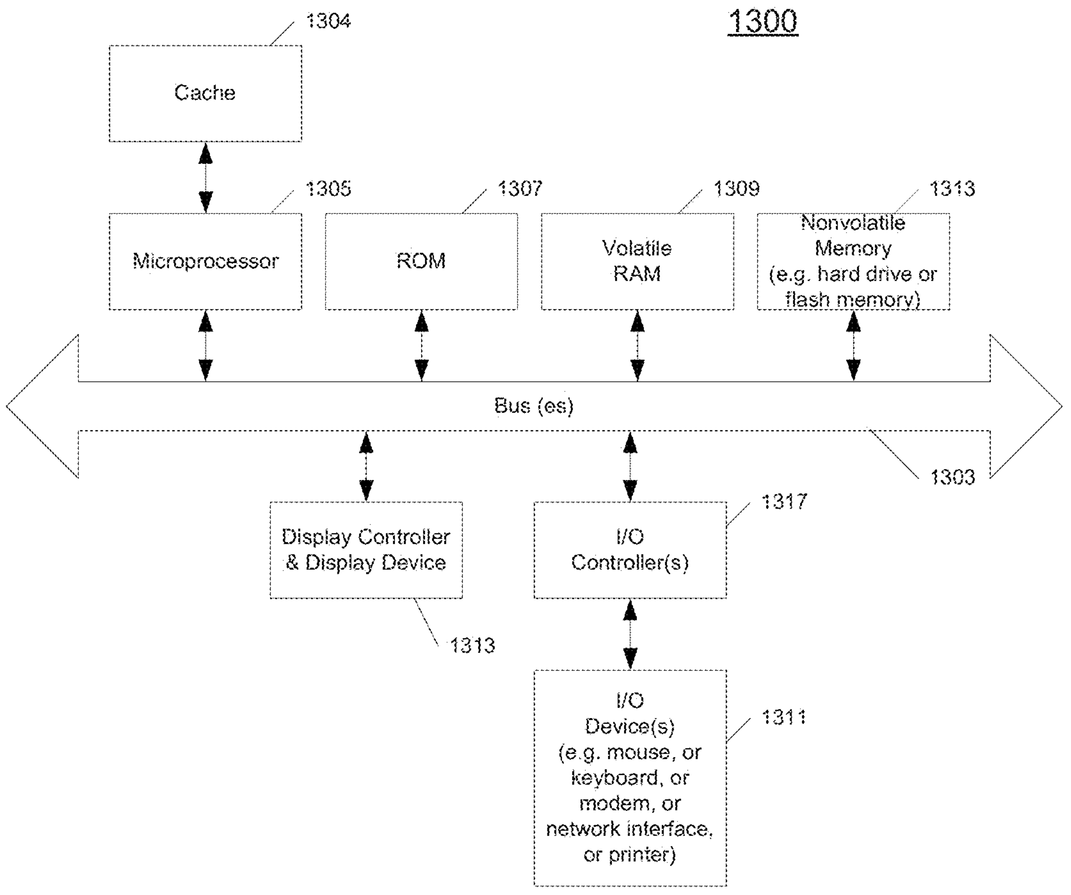

1300
1304
Cache
1305
Microprocessor
1307
ROM
1309
Volatile RAM
1313
Nonvolatile Memory (e.g. hard drive or flash memory)
Bus (es)
1303
Display Controller & Display Device
1313
1317
I/O Controller(s)
I/O Device(s) (e.g. mouse, or keyboard, or modem, or network interface, or printer)
1311

Fig. 13

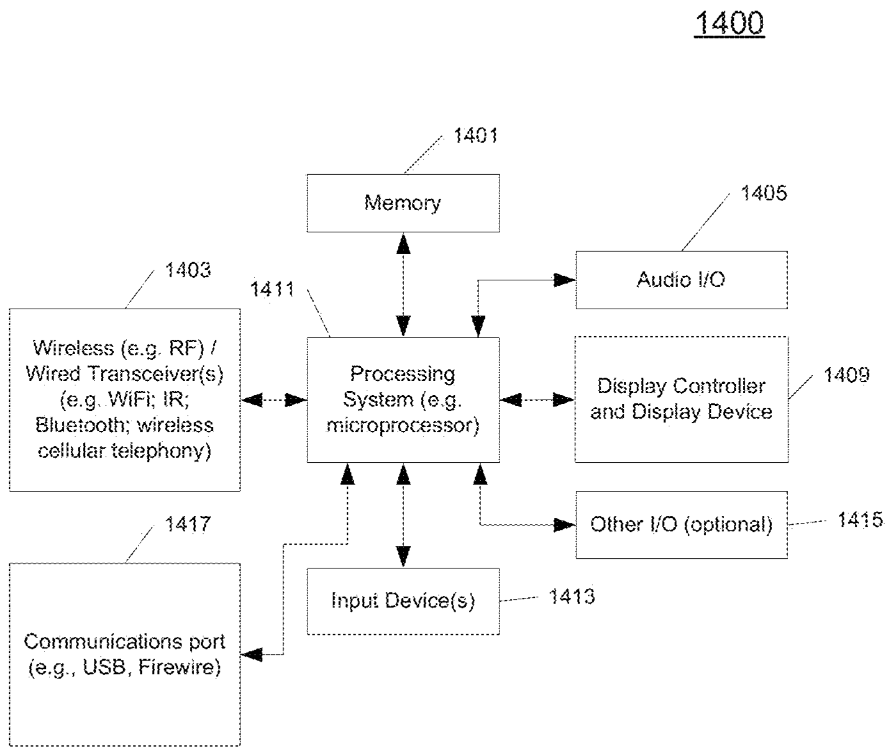

1400
1401
Memory
1405
Audio I/O
1403
1411
Wireless (e.g. RF) / Wired Transceiver(s) (e.g. WiFi; IR; Bluetooth; wireless cellular telephony)
Processing System (e.g. microprocessor)
Display Controller and Display Device
1409
1417
Other I/O (optional)
1415
Input Device(s)
1413
Communications port (e.g., USB, Firewire)

Fig. 14

NETWORK STREAM IDENTIFICATION FOR OPEN FACETIME

FIELD OF INVENTION

[0001] This invention relates generally to data networking and more particularly to identifying different network packet types communicated over a single port between a pair of devices.

BACKGROUND OF THE INVENTION

[0002] Modern network connections between applications running on a pair of devices will use a port to communicate data between these pair of devices. A port is an endpoint in a bidirectional communication flow across a computer network. An application communicates with a remote device through one or more ports.

[0003] While some applications can use different ports to communicate packets of different protocols, there are advantages to transmitting and receiving packets over the same port for multiple network protocols. For example, a FaceTime video call uses a single port for various signaling and media packets of different protocols. Protocols used include Session Initiation Protocol (SIP) to establish the call, Internet Connectivity Establishment (ICE) protocol to establish a session across firewall, and Real Time Protocol (RTP) to delivering real-time and encrypted media streams.

[0004] In order for different types of packets (e.g., SIP, ICE, and RTP packets) to be communicated across the same port, there is a need to differentiate the different types of packets so that a FaceTime client can appropriately process the different packet types.

SUMMARY OF THE DESCRIPTION

[0005] A method and apparatus of a device that of distinguishes multiplexed media and signaling data traffic is described. In an exemplary embodiment, the device receives, on a single port, a packet of the multiplexed data traffic, where the multiplexed data traffic includes a plurality of packets and each of the plurality of packets is one of a media packet and an encapsulated signaling packet. The device further examines an initial data element of a header of the received packet to determine if the received packet is one of a media packet and a signal packet. The device further forwards the packet to a corresponding module for further processing based on the examining.

[0006] In a further embodiment, a method and device that switches multiplexed data traffic received on a single port is described. The method receives, on a single port, a stream of the multiplexed data traffic, where the multiplexed data traffic includes a plurality of encapsulated signaling packets. In addition, each of the plurality of encapsulated packets is an encapsulated signaling packet of different network protocols and the multiplexed data traffic includes at least one of the encapsulated signaling packets for each of the different signaling protocols. The method further switches each of the plurality of encapsulated data packets to a corresponding module for further processing, the switching based on a header of that encapsulated data packet.

[0007] Other methods and apparatuses are also described.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The present invention is illustrated by way of example and not limitation in the figures of the accompanying drawings in which like references indicate similar elements.

[0009] FIG. **1** is a block diagram of one embodiment of system that communicates data between two devices.

[0010] FIG. **2** is a block diagram of one embodiment of a pair of devices communicating data using multiple network packet types over one port.

[0011] FIG. **3** is a flow diagram of one embodiment of a process to establish a FaceTime call between two devices.

[0012] FIG. **4** is a block diagram of one embodiment of a VTP packet.

[0013] FIG. **5** is a block diagram of one embodiment of an extension block of a VTP packet.

[0014] FIG. **6** is a block diagram of one embodiment of a fragmentation block of a VTP packet.

[0015] FIG. **7** is a block diagram of one embodiment of an open FaceTime packet.

[0016] FIG. **8** is a flow diagram of one embodiment of a process that processes different packet types received on one port.

[0017] FIG. **9** is block diagram of one embodiment of an open FaceTime Internet Connectivity Establishment (ICE) packet.

[0018] FIG. **10** is a block diagram of one embodiment of an open FaceTime handshake packet.

[0019] FIG. **11** is a block diagram of one embodiment of an open FaceTime Session Initiation Protocol (SIP) packet.

[0020] FIG. **12** is a block diagram of a FaceTime switch module to process a possible open FaceTime packet.

[0021] FIG. **13** illustrates one example of a typical computer system, which may be used in conjunction with the embodiments described herein.

[0022] FIG. **14** shows an example of a data processing system, which may be used with one embodiment of the present invention.

DETAILED DESCRIPTION

[0023] A method and apparatus of a device that distinguishes multiplexed media and signaling data traffic is described. In the following description, numerous specific details are set forth to provide thorough explanation of embodiments of the present invention. It will be apparent, however, to one skilled in the art, that embodiments of the present invention may be practiced without these specific details. In other instances, well-known components, structures, and techniques have not been shown in detail in order not to obscure the understanding of this description.

[0024] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification do not necessarily all refer to the same embodiment.

[0025] In the following description and claims, the terms "coupled" and "connected," along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. "Coupled" is used to indicate that two or more elements, which may or may not be in direct physical or electrical contact with each other, co-operate or interact with each other. "Connected" is used to indicate the establishment of communication between two or more elements that are coupled with each other.

[0026] The processes depicted in the figures that follow, are performed by processing logic that comprises hardware (e.g., circuitry, dedicated logic, etc.), software (such as is run on a general-purpose computer system or a dedicated machine), or a combination of both. Although the processes are described below in terms of some sequential operations, it should be appreciated that some of the operations described may be performed in different order. Moreover, some operations may be performed in parallel rather than sequentially.

[0027] The terms "server," "client," and "device" are intended to refer generally to data processing systems rather than specifically to a particular form factor for the server, client, and/or device.

[0028] A method and apparatus of a device that distinguishes multiplexed media and signaling data traffic received on one port is described. The device receives, on a single port, a packet of the multiplexed data traffic. The device examines an initial data element of the header of the received packet to determine if the received packet is a media packet or a signaling packet. For example, the received packet could be an RTP packet, SIP packet, handshake packet, ICE packet, etc. If the packet is a media packet, the device forwards the packets to a media packet processing module. If the packet is a signaling packet, the device further examines other fields in the header to determine what type of signaling packet has been received. For example, the device examines the type field of the signaling packet to determine if the packet is a SIP, ICE, or handshake packet. In addition, the device strips the header from the packet and processes the according to the signaling packet type.

[0029] FIG. **1** is a block diagram of one embodiment of system that communicates data between two devices. In FIG. **1**, the system **100** includes devices **102**A-B that are coupled via network **108**. While in one embodiment, network **108** is the Internet, in alternate embodiments, network **108** is another type of network (intranet, etc., or another type of network as known in the art). Devices **102** A-B can each be one of a mobile device (smartphone, laptop, personal digital assistant, music playing device, gaming device, etc.), personal computer, etc., or any other device capable of handling a media call (e.g., a FaceTime call). In one embodiment, device **102**A includes one or more different interfaces that are used to communicate data with device **102**B. For example and in one embodiment, device **102**A may includes wireless interface (e.g., 802.11a/b/g/n, 802.16 WIMAX, etc. or other wireless interface as known in the art), cellular data interface (e.g. 3G CDMA, 3G UMTA, 4G/LTE, etc. or another cellular data interface as known in the art), and/or wired interface (Ethernet or another wired interface as known in the art). Similarly, device **102**B may include one or more interfaces, such as wireless interface, cellular data interface, and/or wired interface.

[0030] Using these different interfaces, devices **102**A-B uses a network connections **104**A-B, respectively, to network **108**. For a certain class of applications (e.g., peer to peer (P2P), video calls (e.g., FaceTime, etc.), voice calls, etc.), these applications use pairs of connections between device **102**A-B. In one embodiment, the devices **104**A-B conduct a FaceTime call over network connections **104**A-B via network **108**. In another embodiment, the devices **104**A-B conduct a FaceTime call over network connections **104**A-B via network **108** and relay **110**.

[0031] In one embodiment, each of the devices **104**A-B uses a number of different protocols to establish and perform a FaceTime call. In one embodiment, a FaceTime call is an audio/video call that allows users to talk and view each other between two devices. For example and in one embodiment, a device establishing and performing a FaceTime call, uses the ICE protocol to establish a network connection with the other device, uses a handshaking protocol to negotiate secure attributes of the FaceTime call, uses the SIP protocol to establish the FaceTime call, and the RTP to communicate audio and video data of the FaceTime call with the other device. In one embodiment, packets for each of these supported protocols are communicated with the device using a single port. By using a single port, it is less complex for the packets of the different network protocols to travel over a firewall or network address translation (NAT) device. In one embodiment, a device performing a FaceTime call, may also initiate a second call with the same or another device. In this embodiment, the device will be handling call setup packets as well as call media packets on that same port.

[0032] In one embodiment, in order to communicate packets of different protocols over a single port, the device communicating these packets will need to differentiate these packets such that the packets can be processed appropriately. For example and in one embodiment, the device identifies packets based on the data in the header of the packet. In one embodiment, the FaceTime module **106**A-B in each device **104**A-B identifies and processes the different types of packets. The FaceTime module **106**A-B is further described in the FIG. **2** below.

[0033] In one embodiment, the FaceTime module **106**A-B can take advantage of a relay to relay data between the devices. In one embodiment, a relay is a server or that is capable of transmitting packets on behalf of one endpoint to a different endpoint over the Internet. For example and in one embodiment, relay is a relay implementing Internet Engineering Task Force (IETF) Draft 5766 relay protocol.

[0034] FIG. **2** is a block diagram of one embodiment of a pair of devices **202**A-B communicating data of multiple packet types over one port. In FIG. **2**, devices **202**A-B each includes a FaceTime module **214**A-B that is used to perform a FaceTime call. In one embodiment, the each of the two FaceTime modules **214**A-B includes a FaceTime switch module **204**A-B, RTP module **206**A-B, SIP module **208**A-B, ICE module **210**A-B, and HSK module **212**A-B. In this embodiment, the FaceTime switch module **204**A-B identifies the different types of packets and forwards the identified packets to the appropriate module. For example and in one embodiment, the FaceTime switch module **204**A-B identifies and forwards different packets to the appropriate module. If the FaceTime switch module **204**A-B identifies an RTP packet, the FaceTime switch module forwards this packet to the RTP module **206**A-B. If the FaceTime switch module **204**A-B identifies an SIP packet, the FaceTime switch module forwards this packet to the SIP module **208**A-B. If the FaceTime switch module **204**A-B identifies an ICE packet, the FaceTime switch module forwards this packet to the ICE module **210**A-B. If the FaceTime switch module **204**A-B identifies a handshake packet, the FaceTime switch module forwards this packet to the handshake module **212**A-B.

[0035] In one embodiment, the FaceTime switch module **204**A-B identifies the different types of packets based on information in the header of the packet. In one embodiment, the FaceTime switch module **204**A-B identifies a packet based on the initial data element in the header of the packet. For example and in one embodiment, if the initial bit of the header is 0, the packet may be an Open FaceTime packet. If this initial bit is 1, the packet may be a RTP packet. In another embodiment, the FaceTime switch module **204**A-B identifies the different type of packets based on a different criteria (packet length heuristic, detecting the relay header, checking the last four bytes for CRC-32, etc.). In one embodiment, packet has had lower layer encapsulation removed (e.g., Ethernet, IP, TCP or UDP layers, etc.) before the FaceTime switch module **204**A-B identifies the packet.

[0036] FIG. **3** is a flow diagram of one embodiment of a process **300** to establish a FaceTime call between two devices. While in one embodiment, process **300** is used to establish a FaceTime call between a device and another device, in alternate embodiments, process **300** can be used by a device multiple times to handle multiple FaceTime calls between one or more other devices. In one embodiment, device **104**A and/or **104**B performs process **300** to establish a FaceTime call with another device. In FIG. **3**, process **300** begins by establishing connectivity between two devices at block **302**. In one embodiment, process **300** establishes connectivity by initiating a network connection discovery with a remote device. In one embodiment, the network connection discovery is performed by communicating with the remote device to understand which interface the remote device has available for creating connection pairs and further, transmit those interfaces to that remote device that are available on the device. In one embodiment, a device uses a protocol Internet Connectivity Establishment (ICE) transaction as known in the art to discover these connection pairs available between two devices. In this embodiment, an ICE transaction uses an open FaceTime packet that encapsulates an ICE packet as illustrated in FIG. **9** below. For example and in one embodiment, the connection is established to allow the handshaking to occur between the two devices. In one embodiment, these ICE messages are not encrypted and are authenticated via data in the Message Authentication Code (MAC) field of the ICE message.

[0037] At block **304**, process **300** performs a handshake with the remote device. In one embodiment, process **300** exchanges open FaceTime handshake (HSK) messages with the remote device. For example and in one embodiment, process **300** is a DTLS client role and the remote device is the DTLS server role. In one embodiment, the open FaceTime HSK messages are not encrypted but are authenticated with the data in the MAC field of the FaceTime HSK messages. If the handshake is not successful, process **300** returns an error, times out, etc. Open FaceTime HSK messages are further described in FIG. **10** below.

[0038] Process **300** sets up the FaceTime call at block **306**. In one embodiment, process **300** sets up the call by exchanging encrypted open FaceTime SIP messages. In this embodiment, these SIP messages establish an open FaceTime call by initiating/accepting the multi-media session, negotiating the audio and video capabilities. In one embodiment, unencrypted open FaceTime SIP messages are rejected. Open FaceTime SIP messages are further described in FIG. **11** below.

[0039] At block **308**, process **300** exchanges media and control messages for the call. In one embodiment, process **300** expands a DTLS shared secret to provide a master encryption key. For example and in one embodiment, process **300** uses a Password-Based Key Derivation Function Hash-based Message Authentication Code Secure Hash Algorithm (PBKDF2-HMAC-SHA-1) function with the session identifier as a “salt” value to generate a master encryption key. In one embodiment, the master encryption key is used to generate the encryption and decryption keys for Secure Real Time Protocol (SRTP). This is done by expanding the master encryption key to form encryption and decryption keys for audio and video streams in both directions. In one embodiment, legacy FaceTime and Open FaceTime packets do not implement the SRTP Master Key Identifier (MKI) and authentication tag. In this embodiment, the encrypted open FaceTime SRTP packet with have the same byte size and format as an unencrypted RTP equivalent. Because these different types of packets have the same byte size, a heuristic based on packet length will be unable to differentiate an open FaceTime SRTP packet and an unencrypted RTP equivalent. In this embodiment, a different way of determining these different packets would be used, such as examining the headers of the each of the packets. Identifying different packets types is further described in FIG. **8** below.

[0040] FIG. **4** is a block diagram of one embodiment of a virtual transport (VTP) packet format **400**. In one embodiment, the VTP packet is a transport layer protocol and defines a packetization format. In one embodiment, open FaceTime packets are VTP packets and can be ICE, SIP, or HSK packet type. In one embodiment, the VTP packet format **400** includes a header of fields **402**A-E, a payload **402**F, and a CRC32 checksum **402**G. In one embodiment, the header **402**A-E includes the first 16 bits (**402**A), a peer identifier **402**B, extension block **402**C, fragmentation block **402**D, and MAC block **402**E. In one embodiment, the first 16 bits of the packet include a V bit, X bit, E bit, F bit, M bit, R bits, and a Type. The V bit identifies the packet as a FaceTime packet. If this bit is set to 0, the packet is a FaceTime packet. The next bit in **402**A, X, identifies whether the packet includes an extension block **402**C. If the X bit is set, the fixed part of the header (**402**A-B) is followed by an extension block **402**C. The next bit, E, identifies if payload **402**F is encrypted. If the E bit is set, the payload **402**F is encrypted. The M bit is the MAC bit. The R bits are reserved. In one embodiment, there three bits for the R bits and these bits are set to 0. In addition, the VTP packet format includes a type. In one embodiment, the type is eight bits long and identifies the type of VTP packet. For example and in one embodiment, the VTP packet type can be an ICE, Handshake, or SIP packet.

[0041] In addition, the VTP packet includes a P2P ID **402**B block, which holds the peer identifier. In one embodiment, the peer identifier is identifies the FaceTime call and is 32 bits long. For example and in one embodiment, the peer identifier is the session ID. In one embodiment, the session ID is randomly generated and used for the duration of the FaceTime call.

[0042] If the X bit is set, the VTP packet will include an extension block **402**C. In one embodiment, the extension block **402**C is a block that is used by a vendor to implement an extension to open FaceTime. For example and in one embodiment, a vendor may wish to implement extend the protocol to add reliability. In this embodiment, the vendor would use the extension block to contain the information for this extension. The extension block **402**D is further described in FIG. **5** below.

[0043] The F bit identifies if the packet includes a fragmentation block **402**D. If the F bit is set, a fragmentation block **402**D will follow after the fixed header (**402**A-B) and extension block **402**C (if there). In one embodiment, the fragmentation block **402**D is used to break up data for a packet over multiple packets. In one embodiment, the fragmentation block **402**D is used if the original packet to be transported in the VTP packet format does not fit in a single packet. The fragmentation block **402**D is further described in FIG. **6** below.

[0044] The M bit identifies if the packet includes a MAC block **402**E. If the M bit is set, a MAC block **402**E will follow after the fixed header (**402**A-B), the extension block **402**C (if there), and the fragmentation block **402**D (if there). If present, the MAC block **402**E includes the secret associated with the session ID that is used to hash the payload.

[0045] The payload **402**F contains the message payload. In one embodiment, the contents of the payload depend on the type of VTP packet. For example and in one embodiment, a VTP packet can be ICE, HSK, SIP as in the open FaceTime packet defined below. In addition, the VTP packet format **400** includes a (Cyclic Redundancy Check) CRC checksum **402**G. In one embodiment, the CRC checksum **402**G is to error check the contents of the VTP packet. While in one embodiment, the checksum **402**G illustrated is a CRC checksum, in alternate embodiments, different types of checksums can be used.

[0046] As described above, a VTP packet can include an extension block. An extension block is used to implement an extension to open FaceTime. FIG. **5** is a block diagram of one embodiment of an extension block **500** of a VTP packet. In FIG. **5**, the extension block **500** includes an extension header **502**A and an extension payload **502**B. The extension header **502**A includes a "Def. by Profile" field that gives flexibility to Open FaceTime users to define proprietary information as an extension to the standard definition and a length field. The length gives the length of the extension payload **502**B. The extension payload **502**B includes the data for the extension.

[0047] In addition, as described above, a VTP packet can include a fragmentation block. A fragmentation block is used to break up data for a packet over multiple packets. FIG. **6** is a block diagram of one embodiment of a fragmentation block of a VTP packet. In FIG. **6**, the fragmentation block **600** includes an S bit **602**A, an E bit **602**B, and a sequence number **602**C. In one embodiment, a packet larger than the network maximum transmission unit needs to be fragmented into smaller pieces that carry the same sequence number. The S bit **602**A indicates the first piece in the group, and the E bit **602**B indicates the last fragmented packet. In addition, the sequence number **602**C includes a sequence number of the fragment.

[0048] FIG. **7** is a block diagram of one embodiment of an open FaceTime packet **700**. In one embodiment, the open FaceTime packet format **700** includes a header of fields **702**A-C, a payload **702**D, and a CRC32 checksum **702**E. In one embodiment, the header **702**A-C includes the first 16 bits (**702**A), a CALLID field **702**B, and a MAC block **702**C. In one embodiment, the first byte of the packet **700** includes an E and M bit, and the second byte is an OPT_ITYPE field. In this embodiment, OPT_ITYPE is used to identify the type of Open FaceTime packet. In an Open FaceTime message, ICE and HSK packets have the E bit reset, and SIP message has the E bit to be set.

[0049] In addition, the header **702**A-C includes the field OFT_ITYPE. In one embodiment, this field stores data to indicate the type of open FaceTime packet. In one embodiment, the CALLID **702**B field holds that call identifier for the FaceTime session. In one embodiment, the call identifier is identifies the FaceTime call and 32 bits long. For example and in one embodiment, the call identifier can be inherited from the FaceTime module **214**A-B.

[0050] Furthermore, the header **702**-C includes the MAC field **702**C. While in one embodiment, the MAC field **702**C is present in the open FaceTime packet **700** (e.g., if the M bit is set), in alternate embodiments the MAC field is not present in the open FaceTime packet **700** (e.g., if the M bit is not set). In addition, in one embodiment, the MAC field **702**C includes data in the field where the first 32 bits of HMAC_SHA1 (variable_packet_data, N) in network-byte-order, keyed by FaceTime sessionID stored as a UTF8 c_string. In one embodiment, the MAC is the Message Authentication Code that is used to authenticate the packet.

[0051] In one embodiment, open FaceTime packet **700** includes the variable packet data **702**D, which stores the packet data for the type of packet. In one embodiment, the size of the packet and the type of data stored in the packet is based on the packet type as indicated by the OFT_ITYPE field. For example and in one embodiment, if the OFT_ITYPE field indicates the packet is an OFT_ITYPE_ICE packet, the variable packet data contains packet data for an ICE packet and is of the length of an ICE packet. For example and in one embodiment, the packet data contains that of an ICE packet defined in RFC5245. In another example and embodiment, if the OFT_ITYPE field indicates the packet is an OFT_ITYPE_HSK packet, the variable packet data contains packet data for an HSK packet and is of the length of an HSK packet. For example and in one embodiment, the packet can include a DTLS handshake data that is used to negotiate secure attributes of the FaceTime call. As a further example and a further embodiment, if the OFT_ITYPE field indicates the packet is an OFT_ITYPE_SIP packet, the variable packet data contains packet data for an SIP packet and is of the length of an SIP packet. For example and in one embodiment, the SIP packet may include a text-based SIP message, such as a SIP request or response. In this example, the SIP messages are used to establish audio/video media methods for an open FaceTime call. Furthermore, the SIP messages may be encrypted.

[0052] In one embodiment, the variable packet data **702**D includes a packet of the type indicated in the OFT_ITYPE field. In this embodiment, open FaceTime packet **700** encapsulates a signaling packet of the type (SIP, HSK, ICE, etc.).

[0053] In one embodiment, the open FaceTime packet **700** includes the CRC__32 checksum field **702**E. In this embodiment, the CRC checksum **702**E is to error check the contents of the open FaceTime packet **700**. While in one embodiment, the checksum **702**E illustrated is a CRC checksum, in alternate embodiments, different types of checksums can be used. In one embodiment, the length of the CRC__32 checksum field is 32 bits. In one embodiment, if the last 32 bits of the packet do not include a valid CRC, this packet is not a valid open FaceTime packet. In this embodiment, the packet may be a valid packet of a different type (RTP audio/video packet, legacy packet type, etc.).

[0054] FIG. **8** is a flow diagram of one embodiment of a process **800** that different packet types received on one port. In FIG. **8**, process **800** begins by receiving a packet at block **802**. In one embodiment, the received packet can be an open FaceTime packet (e.g., open FaceTime ICE, open FaceTime handshake, open FaceTime SIP packets), or a different type of packets (e.g., RTP audio/video packet, legacy packet type, etc.). In this embodiment, process **800** receives the packet one the same port used for other packets involved in the FaceTime call. At block **804**, process **800** determines if the initial bit of the received packet is zero. For example and in one embodiment, the received packet includes a header and a payload, where the header is stored before the payload. In this example, process **800** examines the initial bit of the header to determine if the initial bit is zero. If the initial bit is not zero, process **800** processes the packet as an RTP packet, at block **806**.

[0055] If the initial bit is zero, at block **808**, process **800** evaluates and validates the CRC in the received packet. In one embodiment, the CRC is stored in a field of the packet at the end of the packet. In this embodiment, process **800** examines the CRC field that is after the payload and determines if the CRC is a valid CRC. For example and in one embodiment, process **800** computes a CRC from the received packet and compares the computed CRC with the stored CRC. If these two CRC values match, process **800** has validated the stored CRC of the received packet. It the two values do not match, the CRC is not validated. If the CRC is not valid, at block **812**, process **800** treats the received packet as a legacy packet. In one embodiment, the legacy packet could be an ICE packet that is of standard RFC 5245 format.

[0056] If the CRC is valid, at block **814**, process **800** determines if the M field of the received packet is set to zero and if the session identification of the received packet is known. In one embodiment, the M field is used to identify the type of open FaceTime packet. For example and in one embodiment, an M field of zero could indicate the received packet is an open FaceTime HSK packet. In addition and in this embodiment, process **800** determines if the session identification is known. In one embodiment, process **800** determines is the session identifier is known by determining if the value in the CALLID field is known to process **800**. For example and in one embodiment, process **800** could check the value in the CALLID field **702**B as described in FIG. **7** above with session identifiers known to process **800**. In this example, the known session identifiers could active FaceTime sessions.

[0057] If the M equals zero and the session identifier is known, at block **816**, process **800** rejects the packet as unauthenticated. In one embodiment, process **800** rejects this packet because the remote side is expected to have this session id as well, so MAC section should be expected for authentication. If either the M field is not zero or the session identifier is not known, at block **818**, process **800** determines if the session identifier is known. In one embodiment, process **800** determines if the session identifier is known by determining if the value in the CALLID field is known to process **800**. For example and in one embodiment, process **800** could check the value in the CALLID field **702**B as described in FIG. **7** above with session identifiers known to process **800**. If the session identifier is not known, process **800** proceeds to block **826**.

[0058] If the session identifier is known, process **800** determines if the M field of the received packet is equal to one. In one embodiment, if the M field of the received packet is equal to one, the packet may be an open FaceTime ICE packet or an open FaceTime SIP packet. If the M field of the received packet is not one (e.g., zero), process **800** rejects the packets. In one embodiment, process **800** rejects this packet because it is not a packet that process **800** recognizes.

[0059] If the M field of the received packet is equal to one, at block **822**, process **800** computes the HMAC_SHA-1 value for the received packet. In one embodiment, process **800** calculates the HMAC_SHA-1 using the SHA1 algorithm and keyed with the session identifier. At block **824**, process **800** compares the computed HMAC_SHA-1 value with the HMAC_SHA-1 value stored in the MAC field of the received packets. For example and in one embodiment, process **800** uses the first 32 bits of HMAC_SHA1 stored in the MAC field **702**C as described in FIG. **7** above. If the computed HMAC_SHA1 is not equal to the HMAC_SHA-1 stored in the MAC field, process **800** rejects the packet as unauthenticated at block **816**.

[0060] If the computed HMAC_SHA1 is equal to the HMAC_SHA-1 stored in the MAC field, process **800** determines if the MAC of the received packet is valid and if the E field of the received packet is equal to zero at block **826**. In one embodiment, the MAC is validated by applying the same calculation on the packet content using the shared key and comparing the calculated value with the MAC value included in the packet. In one embodiment, if the E field of the received packet is equal to one, the received packet may be an open FaceTime SIP packet or an open FaceTime ICE packet. If the MAC is valid and the E field of the received packet is zero, at block **830**, process **800** strips the header of the received packet. In one embodiment, process **800** strips the packet by removing the open FaceTime headers and CRC fields from the received packet. For example and in one embodiment, process **800** removes the header **702**A, CALLID **702**B, MAC **702**C, and CRC **702**E fields from the packet, leaving the variable packet data **702**D. Process **800** processes this unencrypted packet at block **832**. In one embodiment, if the packet has the M and E field to be one and zero respectively, process **800** will process the packet as an open FaceTime ICE packet.

[0061] If, at block **826**, the E field is zero, at block **834**, process **800** strips the header and decrypts the packet. In one embodiment, process **800** strips the packet by removing the open FaceTime headers and CRC. For example and in one embodiment, process **800** removes the header **702**A, CALLID **702**B, MAC **702**C, and CRC **702**E from the packet, leaving the variable packet data **702**D. Furthermore, in this embodiment, process **800** decrypts the packet by a DTLS decryption scheme.

[0062] At block **836**, process **800** determines if the handshake for the session identified by the packet is completed. In one embodiment, process **800** determines if the handshake is completed by checking if the handshake procedure has been carried out to completion. If the handshake is not completed, process **800** rejects the packet at block **840**. If the handshake for the packet is completed, process **800** decrypts the packet at block **838**. In one embodiment, process **800** decrypts the packet by a DTLS decryption scheme. Process **800** processes the unencrypted packet at block **832**.

[0063] As described above, process **800** process three different types of open FaceTime packets: open FaceTime ICE packet, open FaceTime HSK packet, and open FaceTime SIP packet. FIGS. **9**-**11** illustrate different embodiments of these open FaceTime packet types.

[0064] FIG. **9** is block diagram of one embodiment of an open FaceTime ICE packet **900**. In one embodiment, the open FaceTime ICE packet **900** includes a header of fields **902**A-C, a payload **902**D, and a CRC32 checksum **902**E. In one embodiment, the header **902**A-C includes the first 16 bits (**902**A), a CALLID field **902**B, and a MAC block **902**C. In one embodiment, the first 16 bits of the packet includes an M bit, and an OFT_ITYPE field. In this embodiment, the M bit is used to indicate if a MAC block is to follow. In one embodiment, the remaining seven of the first eight bits are zero.

[0065] In addition, the header **902**A-C includes the field OFT_ITYPE_ICE. This field is used to identify the packet as an open FaceTime ICE packet. For example and in one embodiment, the value 0x01 indicates an open FaceTime ICE packet. In one embodiment, the CALLID **902**B field holds that call identifier for the FaceTime session. In one embodiment, the call identifier is identifies the FaceTime call and is 32 bits long.

[0066] Furthermore, the header **902**A-C includes the MAC field **902**C. While in one embodiment, the MAC field **902**C is present in the open FaceTime ICE packet **900**, in alternate embodiments the MAC field is not present in the open FaceTime ICE packet **900**. In addition, in one embodiment, the MAC field **902**C includes data in the field where the first 32 bits of HMAC_SHA1 (variable_packet_data, N) in network-byte-order, keyed by FaceTime sessionID as a UTF8 c_string.

[0067] In one embodiment, open FaceTime ICE packet **900** includes the variable packet data **902**D for the ICE packet. For example and in one embodiment, the variable packet data format conforms to RFC 5245.

[0068] In one embodiment, the open FaceTime ICE packet **900** includes the CRC__32 checksum field **902**E. In this embodiment, the CRC checksum **902**E is to error check the contents of the open FaceTime ICE packet **900**. While in one embodiment, the checksum **902**E illustrated is a CRC checksum, in alternate embodiments, different types of checksums can be used. In one embodiment, the length of the CRC__32 checksum field is 32 bits. In one embodiment, if the last 32 bits of the packet do not include a valid CRC, this packet is not a valid open FaceTime packet. In this embodiment, the packet may be a valid packet of a different type (e.g., a legacy ICE packet type, etc.).

[0069] FIG. **10** is a block diagram of one embodiment of an open FaceTime handshake packet **1000**. In one embodiment, the open FaceTime HSK packet **1000** includes a header of fields **1002**A-C, a payload **1002**D, and a CRC32 checksum **1002**E. In one embodiment, the header **1002**A-C includes the first 16 bits (**1002**A), a CALLID field **1002**B, and a MAC block **1002**C. In one embodiment, the first 16 bits of the packet includes an M bit, and an OFT_ITYPE field. In this embodiment, the M bit is used to indicate if a MAC block is to follow. In one embodiment, the remaining seven of the first eight bits are zero.

[0070] In addition, the header **1002**A-C includes the field OFT_ITYPE_HSK. This field is used to identify the packet as an open FaceTime HSK packet. For example and in one embodiment, the value 0x02 indicates an open FaceTime ICE packet. In one embodiment, the CALLID **1002**B field holds that call identifier for the FaceTime session. In one embodiment, the call identifier is identifies the FaceTime call and is 32 bits long.

[0071] Furthermore, the header **1002**A-C includes the MAC field **1002**C. While in one embodiment, the MAC field **1002**C is present in the open FaceTime HSK packet **1000**, in alternate embodiments the MAC field is not present in the open FaceTime HSK packet **1000**. In addition, in one embodiment, the MAC field **1002**C includes data in the field where the first 32 bits of HMAC_SHA1 (variable_packet_data, N) in network-byte-order, keyed by FaceTime sessionID stored as a UTF8 c_string.

[0072] In one embodiment, open FaceTime HSK packet **1000** includes the variable packet data **1002**D for the HSK packet. In one embodiment, the variable packet data **1002**D includes a DTLS handshake packet that is used to negotiate secure attributes of the FaceTime call.

[0073] In one embodiment, the open FaceTime HSK packet **1000** includes the CRC__32 checksum field **1002**E. In this embodiment, the CRC checksum **1002**E is to error check the contents of the open FaceTime HSK packet **1000**. While in one embodiment, the checksum **1002**E illustrated is a CRC checksum, in alternate embodiments, different types of checksums can be used. In one embodiment, the length of the CRC__32 checksum field is 32 bits. In one embodiment, if the last 32 bits of the packet do not include a valid CRC, this packet is not a valid open FaceTime HSK packet.

[0074] FIG. **11** is a block diagram of one embodiment of an open FaceTime SIP packet **1100**. In one embodiment, the open FaceTime SIP packet **1100** includes a header of fields **1102**A-C, a payload **1102**D, and a CRC32 checksum **1102**E. In one embodiment, the header **1102**A-C includes the first 16 bits (**1102**A), a CALLID field **1102**B, and a MAC block **1102**C. In one embodiment, the first 16 bits of the packet includes an M bit, and an OFT_ITYPE field. In this embodiment, the M bit is used to indicate if a MAC block is to follow. In one embodiment, the E bit is set to 1, and the remaining six of the first eight bits are zeros.

[0075] In addition, the header **1102**A-C includes the field OFT_ITYPE_SIP. This field is used to identify the packet as an open FaceTime SIP packet. For example and in one embodiment, the value 0x03 indicates an open FaceTime SIP packet. In one embodiment, the CALLID **1102**B field holds that call identifier for the FaceTime session. In one embodiment, the call identifier is identifies the FaceTime call and is 32 bits long.

[0076] Furthermore, the header **1102**A-C includes the MAC field **1102**C. While in one embodiment, the MAC field **1102**C is present in the open FaceTime SIP packet **1100**, in alternate embodiments the MAC field is not present in the open FaceTime SIP packet **1100**. In addition, in one embodiment, the MAC field **1102**C includes data in the field where the first 32 bits of HMAC_SHA1 (variable_packet_data, N) in network-byte-order, keyed by FaceTime sessionID stored as a UTF8 c_string.

[0077] In one embodiment, open FaceTime SIP packet **1100** includes the variable packet data **1102**D for the SIP packet. For example and in one embodiment, the SIP packet includes a text-based SIP message, such as a SIP request or response.

[0078] In one embodiment, the open FaceTime SIP packet **1100** includes the CRC__32 checksum field **1102**E. In this embodiment, the CRC checksum **1102**E is to error check the contents of the open FaceTime SIP packet **1100**. While in one embodiment, the checksum **1102**E illustrated is a CRC checksum, in alternate embodiments, different types of checksums can be used. In one embodiment, the length of the CRC__32 checksum field is 32 bits. In one embodiment, if the last 32 bits of the packet do not include a valid CRC, this packet is not a valid open FaceTime packet. In this embodiment, the packet may be a valid packet of a different type (e.g., legacy SIP packet type).

[0079] FIG. **12** is a block diagram of a FaceTime switch module **204**A-B to process a possible open FaceTime packet. In one embodiment, the FaceTime switch module **204**A-B includes receive packet module **1202**, RTP check module **1204**, CRC module **1206**, session identifier module **1208**, reject packet module **1210**, type bit module **1212**, MAC module **1214**, MAC valid module **1216**, strip packet module **1218**, handshake module **1220**, and decrypt module **1222**. In one embodiment, the receive packet module **1202** receives the packet as described in FIG. **8**, block **802** above. In one embodiment, the RTP check module **1204** checks to determine if the packet is an RTP packet or some other type of packet as described in FIG. **8**, block **804** above. In one embodiment, the CRC module evaluates and validates the CRC of the packet as described in FIG. **8**, block **806** above. In one embodiment, the session identifier module **1208** determines if the session identifier is known as described in FIG. **8**, blocks **814** and **818** above. In one embodiment, the reject packet module **1210** rejects the packet as described in FIG. **8**, blocks **816** and **840** above. In one embodiment, the type bit module **1212** determines the type bits as described in FIG. **8**, blocks **814**, **820**, **826**, and **828** above. In one embodiment, the MAC module **1214** computes the MAC values as described in FIG. **8**, block **822** above. In one embodiment, the MAC valid module **1216** validates the computed MAC as described in FIG. **8**, block **824** above. In one embodiment, the strip packet module **1218** strips the header from the packet as described in FIG. **8**, blocks **830** and **834** above. In one embodiment, the handshake module **1220** determines if the handshake is completed as described in FIG. **8**, block **836** above. In one embodiment, the decrypt module **1222** decrypts the packet data as described in FIG. **8**, blocks **834** and **838** above.

[0080] FIG. **13** shows one example of a data processing system **1300**, which may be used with one embodiment of the present invention. For example, the system **1300** may be implemented including a device **102**A-B as shown in FIG. **1**. Note that while FIG. **13** illustrates various components of a computer system, it is not intended to represent any particular architecture or manner of interconnecting the components as such details are not germane to the present invention. It will also be appreciated that network computers and other data processing systems or other consumer electronic devices, which have fewer components or perhaps more components, may also be used with the present invention.

[0081] As shown in FIG. **13**, the computer system **1300**, which is a form of a data processing system, includes a bus **1303** which is coupled to a microprocessor(s) **1305** and a ROM (Read Only Memory) **1307** and volatile RAM **1309** and a non-volatile memory **1311**. The microprocessor **1305** may retrieve the instructions from the memories **1307**, **1309**, **1311** and execute the instructions to perform operations described above. The bus **1303** interconnects these various components together and also interconnects these components **1305**, **1307**, **1309**, and **1311** to a display controller and display device **1313** and to peripheral devices such as input/output (I/O) devices which may be mice, keyboards, modems, network interfaces, printers and other devices which are well known in the art. Typically, the input/output devices **1315** are coupled to the system through input/output controllers **1317**. The volatile RAM (Random Access Memory) **1309** is typically implemented as dynamic RAM (DRAM), which requires power continually in order to refresh or maintain the data in the memory.

[0082] The mass storage **1311** is typically a magnetic hard drive or a magnetic optical drive or an optical drive or a DVD RAM or a flash memory or other types of memory systems, which maintain data (e.g. large amounts of data) even after power is removed from the system. Typically, the mass storage **1311** will also be a random access memory although this is not required. While FIG. **13** shows that the mass storage **1311** is a local device coupled directly to the rest of the components in the data processing system, it will be appreciated that the present invention may utilize a non-volatile memory which is remote from the system, such as a network storage device which is coupled to the data processing system through a network interface such as a modem, an Ethernet interface or a wireless network. The bus **1303** may include one or more buses connected to each other through various bridges, controllers and/or adapters as is well known in the art.

[0083] FIG. **14** shows an example of another data processing system **1400** which may be used with one embodiment of the present invention. For example, system **1400** may be implemented as a device **102**A-B as shown in FIG. **1**. The data processing system **1400** shown in FIG. **14** includes a processing system **1411**, which may be one or more microprocessors, or which may be a system on a chip integrated circuit, and the system also includes memory **1401** for storing data and programs for execution by the processing system. The system **1400** also includes an audio input/output subsystem **1405**, which may include a microphone and a speaker for, for example, playing back music or providing telephone functionality through the speaker and microphone.

[0084] A display controller and display device **1409** provide a visual user interface for the user; this digital interface may include a graphical user interface which is similar to that shown on a Macintosh computer when running OS X operating system software, or Apple iPhone when running the iOS operating system, etc. The system **1400** also includes one or more wireless transceivers **1403** to communicate with another data processing system, such as the system **1400** of FIG. **14**. A wireless transceiver may be a WLAN transceiver, an infrared transceiver, a Bluetooth transceiver, and/or a wireless cellular telephony transceiver. It will be appreciated that additional components, not shown, may also be part of the system **1400** in certain embodiments, and in certain embodiments fewer components than shown in FIG. **14** may also be used in a data processing system. The system **1400** further includes one or more communications ports **1417** to communicate with another data processing system, such as the system **1500** of FIG. **15**. The communications port may be a USB port, Firewire port, Bluetooth interface, etc.

[0085] The data processing system **1400** also includes one or more input devices **1413**, which are provided to allow a user to provide input to the system. These input devices may be a keypad a keyboard or a touch panel or a multi touch panel. The data processing system **1400** also includes an optional input/output device **1415** which may be a connector for a dock. It will be appreciated that one or more buses, not shown, may be used to interconnect the various components as is well known in the art. The data processing system shown in FIG. **14** may be a handheld computer or a personal digital assistant (PDA), or a cellular telephone with PDA like functionality, or a handheld computer which includes a cellular telephone, or a media player, such as an iPod, or devices which combine aspects or functions of these devices, such as a media player combined with a PDA and a cellular telephone in one device or an embedded device or other consumer electronic devices. In other embodiments, the data processing system **1400** may be a network computer or an embedded processing device within another device, or other types of data processing systems, which have fewer components or perhaps more components than that shown in FIG. **14**.

[0086] At least certain embodiments of the inventions may be part of a digital media player, such as a portable music and/or video media player, which may include a media processing system to present the media, a storage device to store the media and may further include a radio frequency (RF) transceiver (e.g., an RF transceiver for a cellular telephone) coupled with an antenna system and the media processing system. In certain embodiments, media stored on a remote storage device may be transmitted to the media player through the RF transceiver. The media may be, for example, one or more of music or other audio, still pictures, or motion pictures.

[0087] The portable media player may include a media selection device, such as a click wheel input device on an iPod® or iPod Nano® media player from Apple, Inc. of Cupertino, Calif., a touch screen input device, pushbutton device, movable pointing input device or other input device. The media selection device may be used to select the media stored on the storage device and/or the remote storage device. The portable media player may, in at least certain embodiments, include a display device which is coupled to the media processing system to display titles or other indicators of media being selected through the input device and being presented, either through a speaker or earphone(s), or on the display device, or on both display device and a speaker or earphone(s). Examples of a portable media player are described in published U.S. Pat. No. 7,345,671 and U.S. published patent number 2004/0224638, both of which are incorporated herein by reference.

[0088] Portions of what was described above may be implemented with logic circuitry such as a dedicated logic circuit or with a microcontroller or other form of processing core that executes program code instructions. Thus processes taught by the discussion above may be performed with program code such as machine-executable instructions that cause a machine that executes these instructions to perform certain functions. In this context, a "machine" may be a machine that converts intermediate form (or "abstract") instructions into processor specific instructions (e.g., an abstract execution environment such as a "virtual machine" (e.g., a Java Virtual Machine), an interpreter, a Common Language Runtime, a high-level language virtual machine, etc.), and/or, electronic circuitry disposed on a semiconductor chip (e.g., "logic circuitry" implemented with transistors) designed to execute instructions such as a general-purpose processor and/or a special-purpose processor. Processes taught by the discussion above may also be performed by (in the alternative to a machine or in combination with a machine) electronic circuitry designed to perform the processes (or a portion thereof) without the execution of program code.

[0089] The present invention also relates to an apparatus for performing the operations described herein. This apparatus may be specially constructed for the required purpose, or it may comprise a general-purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), RAMs, EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus.

[0090] A machine readable medium includes any mechanism for storing or transmitting information in a form readable by a machine (e.g., a computer). For example, a machine readable medium includes read only memory ("ROM"); random access memory ("RAM"); magnetic disk storage media; optical storage media; flash memory devices; etc.

[0091] An article of manufacture may be used to store program code. An article of manufacture that stores program code may be embodied as, but is not limited to, one or more memories (e.g., one or more flash memories, random access memories (static, dynamic or other)), optical disks, CD-ROMs, DVD ROMs, EPROMs, EEPROMs, magnetic or optical cards or other type of machine-readable media suitable for storing electronic instructions. Program code may also be downloaded from a remote computer (e.g., a server) to a requesting computer (e.g., a client) by way of data signals embodied in a propagation medium (e.g., via a communication link (e.g., a network connection)).

[0092] The preceding detailed descriptions are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the tools used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of operations leading to a desired result. The operations are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0093] It should be kept in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the above discussion, it is appreciated that throughout the description, discussions utilizing terms such as "receiving," "examining," "transmitting," "rejecting," "forwarding," "encapsulating," "de-encapsulating," "computing," "comparing," "stripping," "switching," "removing," or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0094] The processes and displays presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct a more specialized apparatus to perform the operations described. The required structure for a variety of these systems will be evident from the description below. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein.

[0095] The foregoing discussion merely describes some exemplary embodiments of the present invention. One skilled in the art will readily recognize from such discussion, the accompanying drawings and the claims that various modifications can be made without departing from the spirit and scope of the invention.

1. A non-transitory machine-readable medium having executable instructions to cause one or more processing units to perform a method of distinguishing multiplexed media and signaling data traffic, the method comprising:
- receiving, on a single port, a packet of the multiplexed data traffic, wherein the multiplexed data traffic includes a plurality of packets and each of the plurality of packets is one of a media packet and a signaling packet;
- examining an initial data element of a header of the received packet to determine if the received packet is one of a media packet and a signal packet;
- forwarding the packet to a corresponding module for further processing based on the examining.

2. The non-transitory machine-readable medium of claim **1**, wherein the media packet is a Real Time (RTP) protocol.

3. The non-transitory machine-readable medium of claim **1**, wherein the signaling packet is an open FaceTime packet.

4. The non-transitory machine-readable medium of claim **3**, wherein the open FaceTime packet encapsulates an unencaspulated signaling packet.

5. The non-transitory machine-readable medium of claim **4**, wherein a type of the unencapsulated signaling packet is selected from the group consisting of Session Initiation Protocol (SIP), handshake protocol, and Internet Connectivity Establishment (ICE) protocol.

6. The non-transitory machine-readable medium of claim **5**, wherein the handshake protocol is Datagram Transport Layer Security (DTLS) protocol.

7. The non-transitory machine-readable medium of claim **4**, further comprising:
- if the packet is an encapsulated signaling packet,
  - determining a type of the unencapsulated signaling packet by examining a type field of the header of the packet; and
  - removing the header of the packet.

8. The non-transitory machine-readable medium of claim **1**, wherein the header includes a session identifier that identifies a FaceTime session associated with the packet.

9. The non-transitory machine-readable medium of claim **1**, wherein the header includes a message authentication code field that stores a cryptographic hash for the packet.

10. The non-transitory machine-readable medium of claim **9**, further comprising:
- computing a cryptographic hash for the packet;
- comparing the computed cryptographic hash with stored cryptographic hash in the message authentication code field of the packet; and
- rejecting the packet as unauthenticated if the computed cryptographic hash is not equal to the stored cryptographic hash.

11. The non-transitory machine-readable medium of claim **9**, wherein the message authentication code field stores the first 32 bits of the cryptographic hash and the comparing compares the first 32 bits of the stored and computed cryptographic hash.

12. The non-transitory machine-readable medium of claim **1**, wherein the initial data element is the first bit of the header of the packet.

13. A non-transitory machine-readable medium having executable instructions to cause one or more processing units to perform a method of switching multiplexed data traffic received on a single port, the method comprising:
- receiving, on the single port, a stream of the multiplexed data traffic, wherein the multiplexed data traffic includes a plurality of encapsulated signaling packets, each of the plurality of encapsulated packets is an encapsulated signaling packet of different network protocols, and the multiplexed data traffic includes at least one of the encapsulated signaling packets for each of the different signaling protocols; and
- switching each of the plurality of encapsulated data packets to a corresponding module for further processing, the switching based on a header of that encapsulated data packet.

14. The non-transitory machine-readable medium of claim **13**, wherein the encapsulated signaling packet is an open FaceTime packet.

15. The non-transitory machine-readable medium of claim **13**, wherein each of the different network protocols is selected from the group consisting of Session Initiation Protocol (SIP), handshake protocol, and Internet Connectivity Establishment (ICE) protocol.

16. The non-transitory machine-readable medium of claim **15**, wherein the handshake protocol is Datagram Transport Layer Security (DTLS) protocol.

17-20. (canceled)

21. The non-transitory machine-readable medium of claim **13**, wherein the method of switching the multiplexed data traffic further comprises:
- removing upper layer headers from the plurality of encapsulated data packets.

22. An apparatus to distinguish multiplexed media and signaling data traffic, the apparatus comprising:
- means for receiving, on a single port, a packet of the multiplexed data traffic, wherein the multiplexed data traffic includes a plurality of packets and each of the plurality of packets is one of a media packet and a signaling packet;
- means for examining an initial data element of a header of the received packet to determine if the received packet is one of a media packet and a signal packet;
- means for forwarding the packet to a corresponding module for further processing based on the examining.

23. The apparatus of claim **22**, further comprising:
- if the packet is an encapsulated signaling packet,
  - means for determining a type of the unencapsulated signaling packet by examining a type field of the header of the packet; and
  - means for removing the header of the packet.

24. The apparatus of claim **22**, wherein the header includes a message authentication code field that stores a cryptographic hash for the packet.

25. The apparatus of claim **24**, further comprising:
- computing a cryptographic hash for the packet;
- comparing the computed cryptographic hash with stored cryptographic hash in the message authentication code field of the packet; and
  - rejecting the packet as unauthenticated if the computed cryptographic hash is not equal to the stored cryptographic hash.

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